

Equipment from Enika – improved functionality and riding comfort in retrofitted NF6D and 116Nd tram cars



For nearly 30 years, Enika has been providing end-to-end electrical and power electronic equipment for new and retrofitted tram cars of various brands. With wide competences and immense experience, Enika offers high quality equipment and full onboard integration of all components per the customer's specifications.

Reliable and failure-free equipment for public transport, which includes light rail vehicles and trams, guarantee the safety, driver's operating comfort, and satisfaction of public transport commuters. Thanks to the application of advanced systems, the equipment service life is longer, which applies equally to the vehicles. Modern power transmission systems provided by Enika are not simply motive systems for trams and LRVs. They include highly advanced and carefully designed solutions critical to safety, cost-efficiency and convenience of commuting.

In 2021, Enika took part in a project to retrofit the 116Nd trams which are commonly called the "Karlik" and operated by Tramwaje Śląskie, and to retrofit the NF6D trams operated by MPK Łódź.

The Konstal 116Nd tram cars were manufactured between 2000 and 2001 by ALSTOM Konstal in Chorzów, Poland. The 116Nd is a single-unit articulated tram car with a 73% low-floor base. It is similar in size to the generation 116N cars, but the technological platform is identical to that of the Konstal NGd99 tram cars (which includes both car end walls made from plastic materials) and the 116Nd is a part of the Citadis 100 family developed by ALSTOM Konstal specifically for the Polish market.

There were seventeen 116Nd tram cars built and they are operated exclusively in the Katowice urban area, running on lines between Katowice, Chorzów, and Bytom, and within the city limits of Katowice.

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From the middle of 2019 to February 2021, Zakład Usługowo-Remontowy of Tramwaje Śląskie retrofitted the 116Nd tram cars. The scope of the retrofit project was very broad, including replacement of the driveline, the switchgear cubicles with the whole electrical wiring system, upgrading of the driver's desk, installation of new, power-folding side mirrors, a complete overhaul of the bogies, including the final drive transmissions, installation of new wheel rim lubrication



systems, replacement of the cabin and exterior lights, replacement of the door panels complete with operating drives and wheelchair access platforms, installation of all new, dark-tint window glass, repair and paint refinishing of the car bodies, installation of new passenger seats and cabin trim, installation of new cooling and heating units for the driver's cab and the passenger section, and replacement of the driver's cab rear wall, complete with a sliding door.

For this retrofit project, Enika manufactured and delivered the ENI-ZNAP/116Nd complete power and driveline systems for four tram cars. Each system comprised a static converter, inverters, a driver's control desk, a tram controller panel, a brake system controller, a battery current sensor, and an outdoor temperature sensor. The retrofitted tram cars passed the test drivers and two are already in public transport service in Silesia, with more soon to be released for operation.

With the retrofit completed by Enika, the 116Nd tram cars are provided with the following additional functionalities:

- The air conditioning has improved the commuters' comfort;
- The car's onboard diagnostic system has been expanded and automated, including a visualisation of equipment operating states directly on the driver's control desk;
- Remote diagnostic capabilities have been added for monitoring the tram cars over the web;
- A data logger feature has been implemented to record the performance of the driveline and other onboard equipment. This helps with easy diagnostics of the operating states;
- A modern, cost-efficient power transmission and driveline system has been installed;
- An emergency driving mode has been added for battery-power only operation to exit a road crossing without the overhead contact system voltage;
- An emergency driving mode has been added for operation with a failed tram car controller;
- Each traction motor is powered by a separate inverter for improved power transmission system reliability;
- Access has been secured to the spare parts which had started to become unavailable for the pre-retrofit driveline solution;
- The components removed during the retrofit projects are now used as a stock of spare parts for non-retrofitted tram cars;
- Precise logging of the power input and output of the tram car has been implemented with a reporting feature.

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The retrofit delivered by Enika has improved the riding comfort by reducing the noise in motion. The “Karlik” runs much more quietly than its pre-retrofit version.

Manufactured between 1992 and 1994, the used Siemens NF6D three-unit, partially low-floor double-ended tram cars were imported from Bochum-Gelsenkirchen and brought into operation in Łódź between 2017 and 2020. They boast a low failure rate with a high riding comfort (for example, all doorways have the floor dropped). The double-ended design is an advantage for the tramway operations in Łódź, as it facilitates service on replacement lines which is a necessity during modernisation of the city’s streets.

The first NF6D unit was retrofitted by February 2021. The project involved replacement of the power transmission system, the driver’s control desk, and the sliding window. The driver’s cab received air conditioning.

The new control desk features a large display with visualisation of the operating parameters and end-to-end diagnostic functions of the car; there is also another display for operation of the CCTV and passenger information systems.



Enika provided the NF6D with the complete ENI-ZNAP/NF6D power transmission and control equipment package, including a static converter, an inverter, a brake system controller, a tram controller panel, a control desk panel, and a door controller. The new components from the Polish manufacturer ensure a very high service availability of the tram car, with shortages of spare parts avoided.

Enika’s retrofit efforts have improved the functionality of the vehicle as follows:

- The driver enjoys increased comfort with the cabin A/C;
- The car’s onboard diagnostic system has been expanded and automated, including a visualisation of the equipment operating states directly on the driver’s control desk;
- A data logger feature has been implemented to record the performance of the driveline and other onboard equipment. This helps with easy diagnostics of the operating states;
- The state-of-the-art, cost-efficient driveline features an emergency driving mode for battery-power-only operation to exit a road crossing without the overhead contact system voltage;
- An emergency driving mode has been added for operation with a failed tram car controller;
- Each traction motor is powered by a separate inverter for improved power transmission system reliability;
- Access has been secured to the spare parts which had started to become unavailable for the pre-retrofit driveline solution;
- The components removed during the retrofit projects are now used as a stock of spare parts for non-retrofitted tram cars;
- Precise logging of the power input and output of the tram car has been implemented with a reporting feature.

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All Enika equipment manufactured and delivered for both retrofit projects, as well as for other new or retrofitted tram cars have passed tests performed by Enika's engineers in dedicated test setups to guarantee reliability and failure-free operation in the future, as confirmed by the satisfied customers.

Since its origins, Enika has actively provided retrofit solutions for tram cars by delivering state-of-the-art equipment. The deliverables include streamlined functionalities, reliable driving, and improved comfort of commuters. This improves the safety of passengers, extends the operating life of tram cars, and makes commuting by tram more comfortable.

Text and resources by courtesy of: Enika Sp. z o.o.